(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 703 588 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
20.09.2006 Bulletin 2006/38

(51) Int Cl.:
H01Q 9/27 (2006.01)

(21) Application number: 05250444.6

(22) Date of filing: 28.01.2005

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU MC NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR LV MK YU

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(54) Low radiating power antenna

(57) An antenna (100) includes a radiating unit, a feeding element (6), and a conductive coupler (5). The radiating unit includes a pair of parallel first and second radiating elements (3, 4). The feeding element (6), which supplies an antenna current from an external source to the first and second radiating elements (3, 4) of the radiating unit, is coupled to the first and second radiating elements (3, 4) of the radiating unit. The conductive coupler (5) is coupled to the first and second radiating elements (3, 4) of the radiating unit for enabling the antenna current to flow along the first and second radiating elements (3, 4) of the radiating unit in opposite directions.

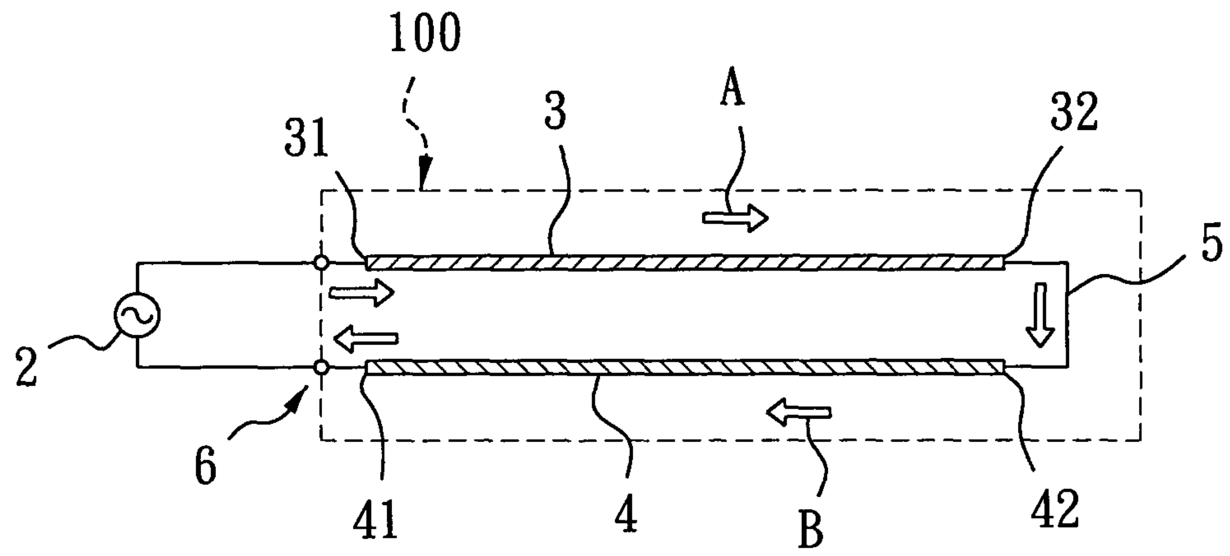

FIG. 1

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Description

[0001] The invention relates to an antenna, more particularly to an antenna that has a relatively low radiating power.

[0002] A conventional antenna, which generates electromagnetic signals within the non-ionizing radiation spectrum (0 to 2.4×10^{25}Hz) for reception by a receiver (not shown), includes a pair of parallel radiating elements and a feeding element. The feeding element is coupled to the radiating elements, and serves to supply an antenna current from an external signal-generating source to the radiating elements. The antenna current flows along the radiating elements in the same direction.

[0003] The aforementioned conventional antenna is disadvantageous in that it has a relatively high radiating power. As such, the receiver requires a filter, which is relatively large and bulky. This is highly undesirable when portability of the receiver is essential.

[0004] Therefore, the object of the present invention is to provide an antenna that is capable of overcoming the aforesaid drawback of the prior art.

[0005] According to the present invention, an antenna comprises a radiating unit, a feeding element, and a conductive coupler. The radiating unit includes a pair of parallel first and second radiating elements. The feeding element, which supplies an antenna current from an external source to the first and second radiating elements of the radiating unit, is coupled to the first and second radiating elements of the radiating unit. The conductive coupler is coupled to the first and second radiating elements of the radiating unit, and enables the antenna current to flow along the first and second radiating elements of the radiation unit in opposite directions.

[0006] Other features and advantages of the present invention will become apparent in the following detailed description of the preferred embodiments with reference to the accompanying drawings, of which:

Figure 1 is a schematic view of the first preferred embodiment of an antenna according to the present invention;
Figure 2 is a schematic view of the second preferred embodiment of an antenna according to the present invention;
Figure 3 is a schematic view of the third preferred embodiment of an antenna according to the present invention;
Figure 4 is a schematic view of the fourth preferred embodiment of an antenna according to the present invention;
Figure 5 is a schematic view of the fifth preferred embodiment of an antenna according to the present invention;
Figure 6 is a schematic view of the sixth preferred embodiment of an antenna according to the present invention;
Figure 7 is a schematic view of the seventh preferred embodiment of an antenna according to the present invention; and
Figure 8 is a schematic view of the eighth preferred embodiment of an antenna according to the present invention.

[0007] Referring to Figure 1, the first preferred embodiment of an antenna 100 according to this invention is shown to include a first radiating unit, a first feeding element 6, and a first conductive coupler 5.

[0008] The first radiating unit includes a pair of parallel first and second radiating elements 3, 4, each of which has first and second ends 31, 41, 32, 42. In this embodiment, each of the first and second radiating elements 3, 4 of the first radiating unit is generally straight. Moreover, the first and second ends 31, 32 of the first radiating element 3 of the first radiating unit are respectively disposed proximate to the first and second ends 41, 42 of the second radiating element 4 of the first radiating unit.

[0009] The first feeding element 6 is coupled to the first ends 31, 41 of the first and second radiating elements 3, 4 of the first radiating unit, and serves to supply an antenna current from an external source 2 to the first and second radiating elements 3, 4 of the first radiating unit.

[0010] The first conductive coupler 5 is coupled to the second ends 32, 42 of the first and second radiating elements 3, 4 of the first radiating unit. The construction as such enables the antenna current to flow from the first end 31 to the second end 32 of the first radiating element 3 of the first radiating unit in a first direction, as indicated by arrow (A), and from the second end 42 to the first end 41 of the second radiating element 4 of the first radiating unit in a second direction, as indicated by arrow (B), opposite to the first direction. In this embodiment, the first conductive coupler 5 is a conductive wire.

[0011] From the above description, since the first and second radiating elements 3, 4 of the first radiating unit are coupled to each other by the first conductive coupler 5, the antenna 100 of this invention has a relatively high antenna impedance and a relatively low antenna inductance. Moreover, since the flows of the antenna current along the first and second radiating elements 3, 4 of the first radiating unit are in opposite directions, electromagnetic signals generated by the first and second radiating elements 3, 4 of the first radiating unit cancels each other in part. Accordingly, the antenna 100 of this invention has a relatively low radiation power, thereby enabling precise control of an operating frequency of the antenna 100.

[0012] Figure 2 illustrates the second preferred embodiment of an antenna 100 according to the present invention. When compared with the previous embodiment, each of the first and second radiating elements 3, 4 of the first radiating unit is generally spiral, and winds around the second end 32, 42 of a respective one of the first and second radiating elements 3, 4 of the first radiating unit. Moreover, each of the first and second radiating elements 3, 4 of the first radiating unit is formed from a coated conductive wire. Further, the first conductive coupler 5 is a resistor.

[0013] It is noted that, in this embodiment, the first and second radiating elements 3, 4 of the first radiating unit lie in the same plane.

[0014] In an alternative embodiment, each of the first and second radiating elements 3, 4 of the first radiating unit may be provided on a printed circuit board or a semiconductor substrate.

[0015] Based on experimental results, when the first conductive coupler 5 has a resistance value of 20Ω, the antenna 100 of this invention has an antenna impedance of 10Ω and an antenna inductance of 90 μH.

[0016] Figure 3 illustrates the third preferred embodiment of an antenna according to the present invention. When compared with the second embodiment, the antenna 100 further includes a second radiating unit, a second feeding element 6', and a second conductive coupler 5'.

[0017] The second radiating unit includes a pair of parallel first and second radiating elements 3', 4', each of which has first and second ends 31' , 41', 32', 42'. Like the first and second radiating elements 3, 4 of the first radiating unit, each of the first and second radiating elements 3' , 4' of the second radiating unit is generally spiral, and winds around the second end 32', 42' of a respective one of the first and second radiating elements 3', 4' of the second radiating unit.

[0018] It is noted, in this embodiment, that the first and second radiating elements 3, 4, 3', 4' of the first and second radiating units lie on the same plane.

[0019] The second feeding element 6' is coupled to the first and second radiating elements 3', 4' of the second radiating unit, and serves to supply an antenna current from the external source 2 to the first and second radiating elements 3' , 4' of the second radiating unit.

[0020] The second conductive coupler 5' is coupled to the second ends 32', 42' of the first and second radiating elements 3', 4' of the second radiating unit.

[0021] Figure 4 illustrates the fourth preferred embodiment of an antenna 100 according to the present invention. When compared with the second embodiment, each of the first and second radiating elements 3, 4 of the first radiating unit includes a plurality of bends, each of which defines a right angle.

[0022] Figure 5 illustrates the fifth preferred embodiment of an antenna 100 according to the present invention. When compared with the second embodiment, the first and radiating elements 3, 4 of the first radiating unit lie in different planes.

[0023] Figure 6 illustrates the sixth preferred embodiment of an antenna 100 according to the present invention. When compared with the previous embodiments, each of the first and second radiating elements 3, 4 of the first radiating element unit is meandering in shape, and includes a plurality of bends, each of which defines a right angle.

[0024] It is noted that, in this embodiment, the first and second radiating elements 3, 4, of the first radiating unit lie in the same plane.

[0025] Figure 7 illustrates the seventh preferred embodiment of an antenna 100 according to the present invention. When compared with the first embodiment, the first and second ends 31, 32 of the first radiating element 3 of the first radiating unit are respectively disposed proximate to the second and first ends 42, 41 of the second radiating element 4 of the first radiating unit. Moreover, the antenna 100 further includes a second conductive coupler 5' that is coupled to the first ends 31, 41 of the first and second radiating elements 3, 4 of the first radiating unit. The construction as such enables the antenna current to flow from the first end 31 to the second end 32 of the first radiating element 3 of the first radiating unit in the first direction, as indicated by arrow (A), and from the first end 41 to the second end 42 of the second radiating element 4 of the first radiating unit through the second coupler 5' in the second direction, as indicated by arrow (B).

[0026] Figure 8 illustrates the eighth preferred embodiment of an antenna 100 according to the present invention. When compared with the seventh embodiment, each of the first and second radiating elements 3, 4 of the first radiating unit is generally spiral. The first radiating element 3 of the first radiating unit winds around the second end 32 of the first radiating element 3 of the first radiating unit, whereas the second radiating element 4 of the first radiating unit winds around the first end 42 of the second radiating element 4 of the first radiating unit.

[0027] Although each of the first and second radiating units of the antenna 100 this invention is exemplified using only at most a pair of first and second radiating elements 3, 4, 3', 4', it should be apparent to those skilled in the art that the number of radiating elements may be increased as required.

Claims

1. An antenna (100), **characterized by**:

a first radiating unit that includes a pair of parallel first and second radiating elements (3, 4);
a first feeding element (6) for supplying an antenna current from an external source to said first and second radiating elements (3, 4) of said first radiating unit, said first feeding element (6) being coupled to said first and second radiating elements (3, 4) of said first radiating unit; and

a first conductive coupler (5) coupled to said first and second radiating elements (3, 4) of said first radiating unit, said first conductive coupler (5) enabling the antenna current to flow along said first and second radiating elements (3, 4) of the first radiating unit in opposite directions.

2. The antenna (100) as claimed in Claim 1, **characterized in that** each of said first and second radiating elements (3, 4) of said first radiating unit is generally straight, and has first and second ends (31, 41, 32, 42), said first and second ends (31, 32) of said first radiating element (3) of said first radiating unit being respectively disposed proximate to said first and second ends (41, 42) of said second radiating element (4) of said first radiating unit, said first feeding element (6) being coupled to said first ends (31, 41) of said first and second radiating elements (3, 4) of said first radiating unit, said first conductive coupler (5) being coupled to said second ends (32, 42) of said first and second radiating elements (3, 4) of said first radiating unit.

3. The antenna (100) as claimed in Claim 1, **characterized in that** each of said first and second radiating elements (3, 4) of said first radiating unit is generally spiral, has first and second ends (31, 41, 32, 42), and winds around said second end (32, 42) of a respective one of said first and second radiating elements (3, 4) of said first radiating unit, said first and second ends (31, 32) of said first radiating element (3) of said first radiating unit being respectively disposed proximate to said first and second ends (41, 42) of said second radiating element (4) of said first radiating unit, said first feeding element (6) being coupled to said first ends (31, 41) of said first and second radiating elements (3, 4) of said first radiating unit, said first conductive coupler (5) being coupled to said second ends (32, 42) of said first and second radiating elements (3, 4) of said first radiating unit.

4. The antenna (100) as claimed in Claim 3, **characterized in that** said first and second radiating elements (3, 4) of said first radiating unit lie on the same plane.

5. The antenna (100) as claimed in Claim 4, further **characterized by**:

a second radiating unit parallel to and lying on the same plane with said first radiating unit, said second radiating unit including a pair of parallel first and second radiating elements (3', 4'), each of which has first and second ends (31', 41', 32', 42'), and winds around said second end (32', 42') of a respective one of said first and second radiating elements (3', 4') of said second radiating unit, said first and second ends (31', 32') of said first radiating element (3') of said second radiating unit being respectively disposed proximate to said first and second ends (41' 42') of said second radiating element (4') of said second radiating unit;
a second feeding element (6') coupled to said first ends (31' 41') of said first and second radiating elements (3' 4') of said second radiating unit; and
a second conductive coupler (5') coupled to said second ends (32',42') of said first and second radiating elements (3', 4') of said second radiating unit.

6. The antenna (100) as claimed in Claim 3, further **characterized in that** each of said first and second radiating elements (3, 4) of said first radiating unit includes bends, each of which defines a right angle.

7. The antenna (100) as claimed in Claim 3, further **characterized in that** said first and second radiating elements (3, 4) of said first radiating unit lie on different planes.

8. The antenna (100) as claimed in Claim 1, further **characterized in that** each of said first and second radiating elements (3, 4) of said first radiating unit is meandering in shape, and has first and second ends (31, 41, 32, 42), said first and second ends (31, 32) of said first radiating element (3) of said first radiating unit being respectively disposed proximate to said first and second ends (41, 42) of said second radiating element (4) of said first radiating unit, said first feeding element (6) being coupled to said first ends (31, 41) of said first and second radiating elements (3, 4) of said first radiating unit, said first conductive coupler (5) being coupled to said second ends (32, 42) of said first and second radiating elements (3, 4) of said first radiating unit.

9. The antenna (100) as claimed in Claim 1, **characterized in that** each of said first and second radiating elements (3, 4) of said first radiating unit is generally straight, and has first and second ends (31, 41, 32, 42), said first and second ends (31, 32) of said first radiating element (3) of said first radiating unit being respectively disposed proximate to said second and first ends (42, 41) of said second radiating element (4) of said first radiating unit, said first feeding element (6) being coupled to said first ends (31, 41) of said first and second radiating elements (3, 4) of said first radiating unit, said first conductive coupler (5) being coupled to said second ends (32, 42) of said first and second radiating elements (3, 4) of said first radiating unit, said antenna (100) being further **characterized by** a second

conductive coupler (5') that is coupled to said first ends (31, 41) of said first and second radiating elements (3, 4) of said first radiating unit.

10. The antenna (100) as claimed in Claim 1, further **characterized in that** each of said first and second radiating elements (3, 4) of said first radiating unit is generally spiral, and has first and second ends (31, 41, 32, 42), said first radiating element (3) of said first radiating unit winding around said second end (32) of said first radiating element (3) of said first radiating unit, said second radiating element (4) of said first radiating unit winding around said first end (41) of said second radiating element (4) of said first radiating unit, said first and second ends (31, 32) of said first radiating element (3) of said first radiating unit being respectively disposed proximate to said second and first ends (42, 41) of said second radiating element (4) of said first radiating unit, said first feeding element (6) being coupled to said first ends (31, 41) of said first and second radiating elements (3,4) of said first radiating unit, said first conductive coupler (5) being coupled to said second ends (32, 42) of said first and second radiating elements (3, 4) of said first radiating unit, said antenna (100) being further **characterized by** a second conductive coupler (5') that is coupled to said first ends (31, 41) of said first and second radiating elements (3, 4) of said first radiating unit.

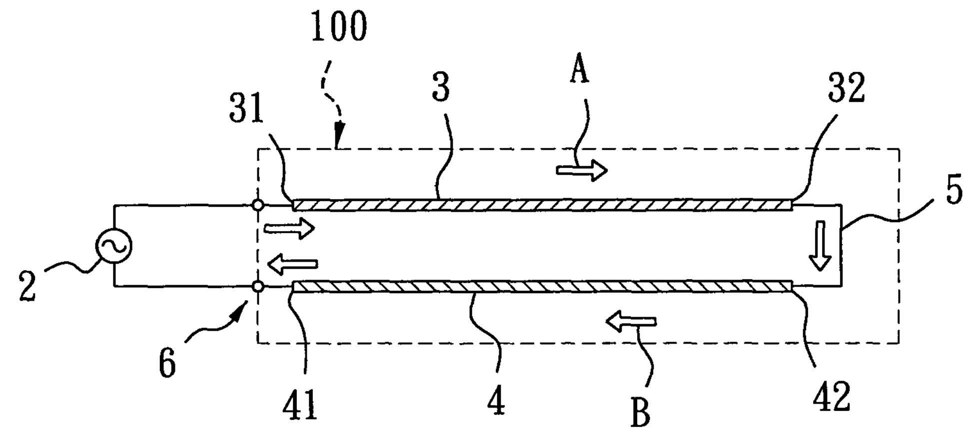

FIG. 1

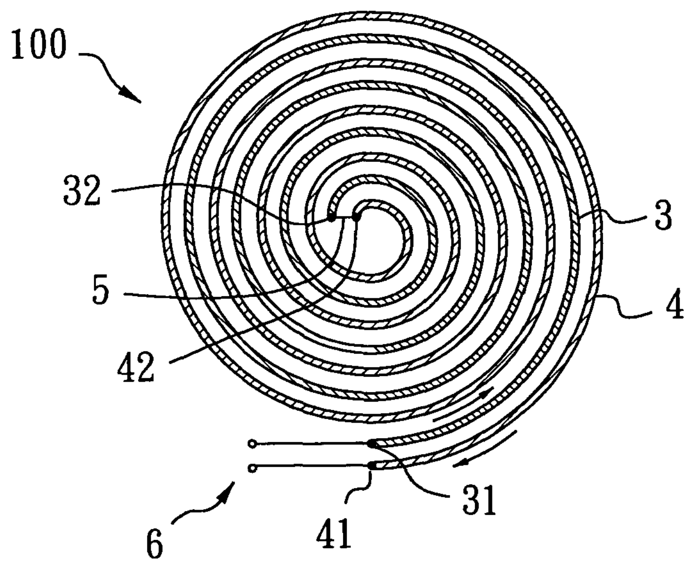

FIG. 2

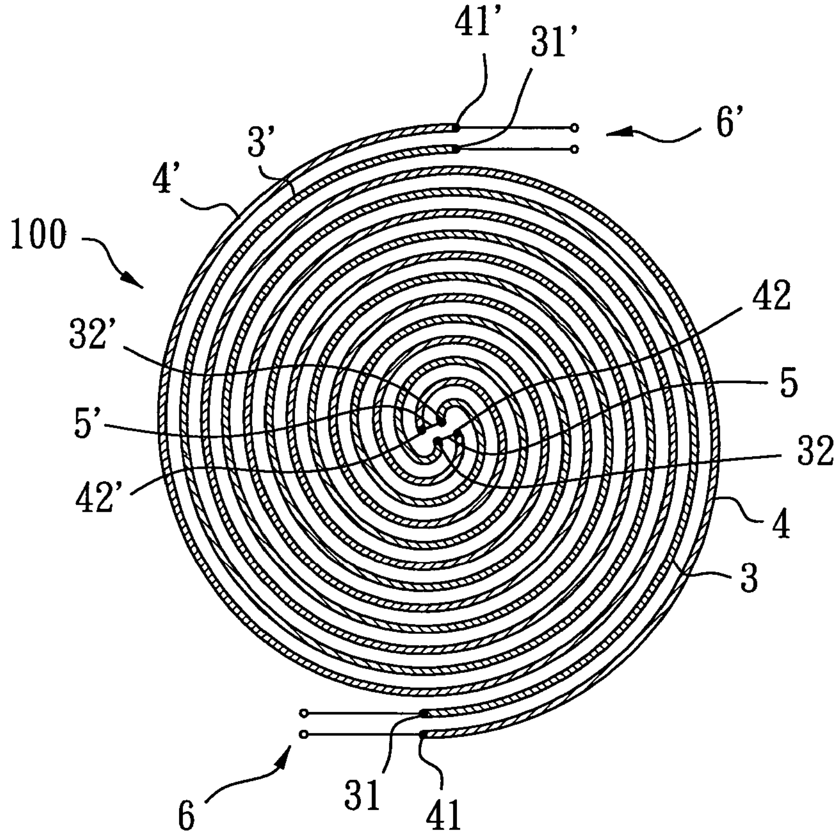

FIG. 3

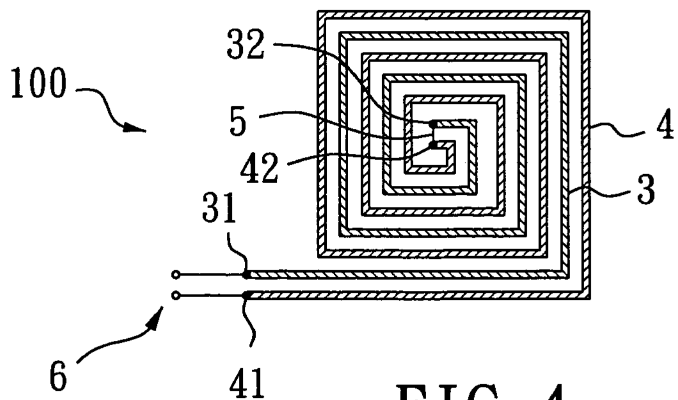

FIG. 4

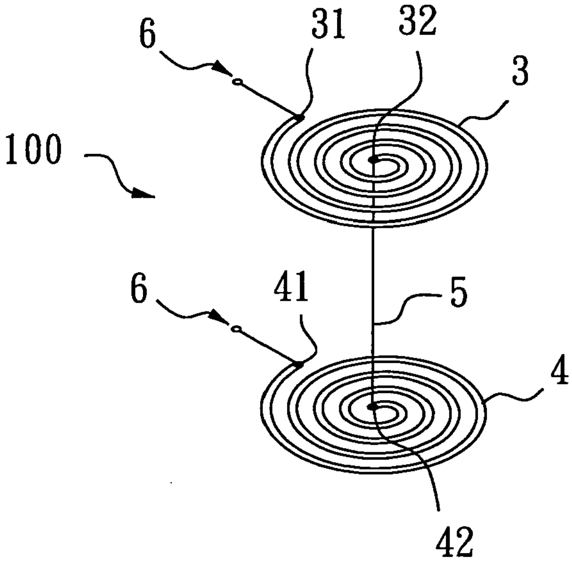

FIG. 5

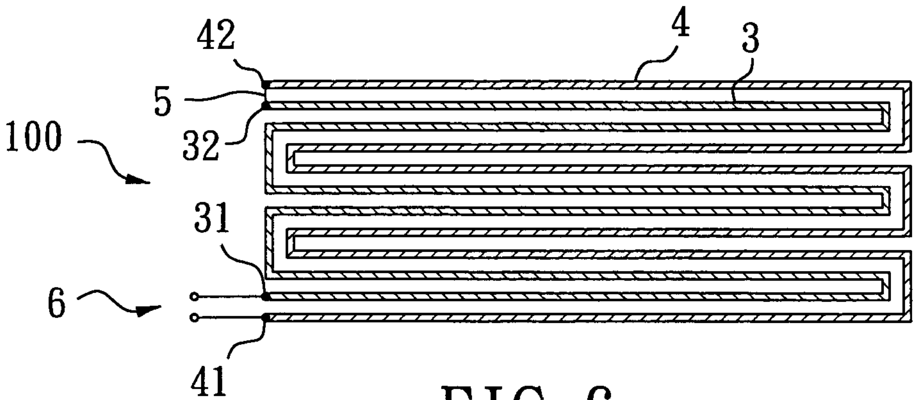

FIG. 6

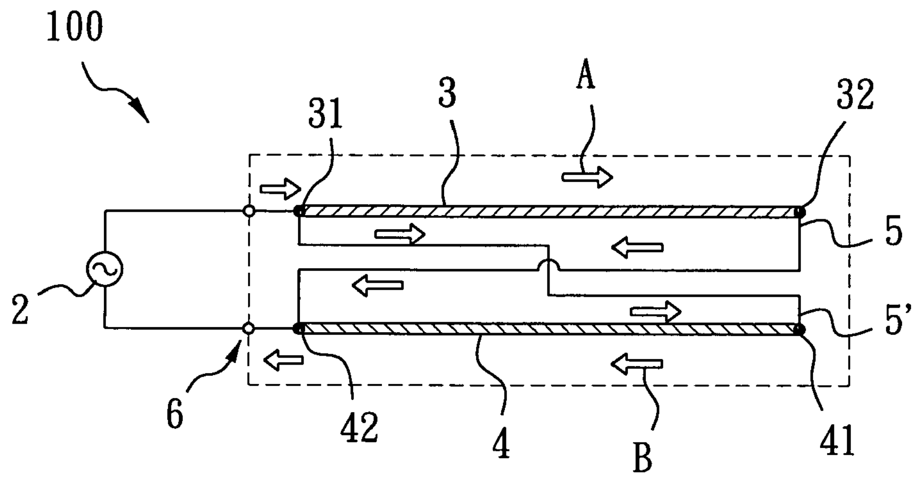

FIG. 7

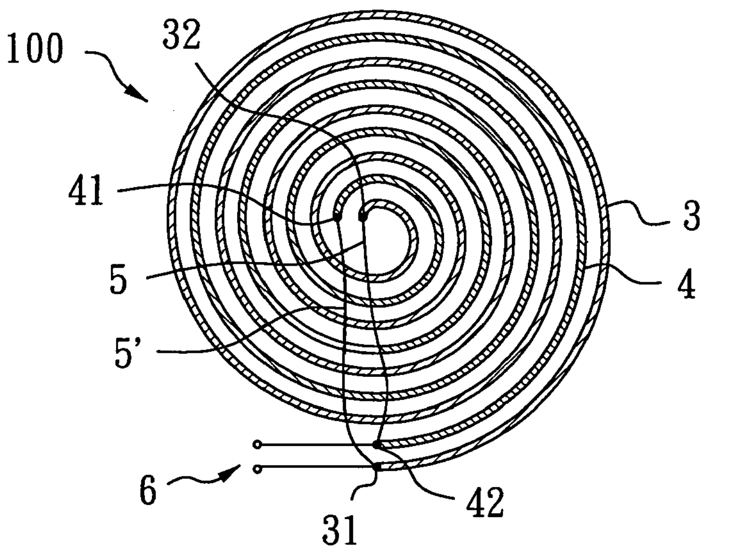

FIG. 8

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EUROPEAN SEARCH REPORT

Application Number
EP 05 25 0444

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 2001/000659 A1 (HAYASHI YOSHIHIKO ET AL) 3 May 2001 (2001-05-03) * paragraphs [0069] - [0071] * * figures 9,10 * -----	1-3,6-9	H01Q9/27
X	DE 199 04 943 A1 (ROBERT BOSCH GMBH) 31 August 2000 (2000-08-31) * column 2, lines 3-41 * * figures 1,2 * -----	1,3-5,9	
A	KRAFT U R: "Polarisation properties of small printed spiral antennas with four resistively loaded arms" IEE PROCEEDINGS: MICROWAVES, ANTENNAS AND PROPAGATION, IEE, STEVENAGE, HERTS, GB, vol. 144, no. 2, 11 April 1997 (1997-04-11), pages 131-135, XP006008750 ISSN: 1350-2417 * figure 1 * -----	5	

TECHNICAL FIELDS SEARCHED (Int.Cl.7)
H01Q

The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	9 May 2005	Kruck, P

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